

**CHI MEI**
OPTOELECTRONICS CORP.

Issued Date: May., 26, 2003

Model No.: M170E6 -L02

Approval

TFT LCD Approval Specification

MODEL NO.: M170E6 -L02

Customer : Samsung Electronics

Approved by : _____

Note :

Liquid Crystal Display Division		
QRA Dept.	TDD I Dept.	PDD I Dept.
Approval	Approval	Approval
		

- CONTENTS -

REVISION HISTORY	3
1. GENERAL DESCRIPTION	4
1.1 OVERVIEW	4
1.2 FEATURES	4
1.3 APPLICATION	4
1.4 GENERAL SPECIFICATIONS	4
1.5 MECHANICAL SPECIFICATIONS	4
2. ABSOLUTE MAXIMUM RATINGS	5
2.1 ABSOLUTE RATINGS OF ENVIRONMENT	5
2.2 ELECTRICAL ABSOLUTE RATINGS	6
2.2.1 TFT LCD MODULE	6
2.2.2 BACKLIGHT UNIT	6
3. ELECTRICAL CHARACTERISTICS	7
3.1 TFT LCD MODULE	7
3.2 BACKLIGHT UNIT	8
4. BLOCK DIAGRAM	10
4.1 TFT LCD MODULE	10
4.2 BACKLIGHT UNIT	10
5. INPUT TERMINAL PIN ASSIGNMENT	11
5.1 TFT LCD MODULE	11
5.2 BACKLIGHT UNIT	12
5.3 COLOR DATA INPUT ASSIGNMENT	13
6. INTERFACE TIMING	14
6.1 INPUT SIGNAL TIMING SPECIFICATIONS	14
6.2 POWER ON/OFF SEQUENCE	15
7. OPTICAL CHARACTERISTICS	16
7.1 TESTING CONDITIONS	16
7.2 OPTICAL SPECIFICATIONS	16
8. PRECAUTIONS	20
8.1 ASSEMBLY AND HANDLING PRECAUTIONS	20
8.2 SAFETY PRECAUTIONS	20
9. DEFINITION OF LABELS	20
9.1 CMO MODULE LABEL	20
10. PACKAGING	21
10.1 PACKING SPECIFICATIONS	21
10.2 PACKING METHOD	21

**REVISION HISTORY**

Version	Date	Section	Description
Ver 0.0	Nov., 20 '02	-	M170E6-L02 Specifications was first issued.
Ver 1.0	Jan., 14 '03	1.5	Weight: TBD(Max.)→1950(Max.)
		3.1	Power Supply Current→ White: 1100(Typ.)/1450(Max.)→1030(Typ.)/1350(Max.) Black: 570(Typ.)/800(Max.)→520(Typ.)/700(Max.) Vertical Stripe: 950(Typ.)/1300(Max.)→930(Typ.)/1250(Max.)
		3.2	Lamp Input Voltage: (616)(Min.)/(685)(Typ.)/(754)(Max.)→ 585(Min.)/650(Typ.)/715(Max.) Lamp Turn On Voltage : (1056)(25℃)/(1674)(0℃)→ 1290(25℃)/1500(0℃) Power Consumption : (17.8)(Typ.)→16.9(Typ.) Modify Note (1) Lamp Drawing
		5.1	Connector Part No.: FI-XB30SRL-HF11 (JAE) or Equivalent
		7.2	White Variation : (1.18)(Typ.)/(1.25)(Max.)→1.25(Typ.)/1.40(Max.) Color Chromaticity → Red : Rx (0.643)(Typ.)/Ry (0.357)(Typ.)→ Rx 0.641(Typ.)/Ry 0.355(Typ.) Green : Gx (0.287)(Typ.)/Gy (0.598)(Typ.)→ Gx 0.285(Typ.)/Gy 0.597(Typ.) Blue : Bx (0.139)(Typ.)/By (0.067)(Typ.)→ Bx 0.142(Typ.)/By 0.071(Typ.) Color Chromaticity Red/Green/Blue (Min.)→Typ - 0.03 Color Chromaticity Red/Green/Blue (Max.)→Typ + 0.03
Ver 2.0	Mar., 12 '03	3.2	Operating Frequency : 45(Min.)/50(Typ.)→40(Min.)/55(Typ.)
		6.1	Horizontal Active Display Term : 144(Min.)→40(Min.)
Ver 3.0	Mar.,19 '03	All	M170E6-L02 Specifications was first issued for LiteOn Technology Corp.
		5.1	Add Note (2). Old Note (2)→new Note (3).
		7.2	Contrast Ratio : 350(Min.)/500(Typ.)→400(Min.)/550(Typ.)
Ver 3.1	Apr.,15 '03	7.2	Contrast Ratio : 550(Typ.)→600(Typ.) Cress Talk : 5.0%(Max.)→2%(Max.) Add Item : Color Gamut Add Item : Gamma value
Ver 3.2	May.,26 '03	7.2	Color gamut : 67(Min) -->70.8 (Min).
		9	Definition of labels
		10	Packaging are newly added sections.



1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M170E6-L02 model is a 17.0" TFT-LCD module with a 4-CCFL Backlight Unit and a 30-pin 2ch-LVDS interface. This module supports 1280 x 1024 SXGA mode and displays 16.7M colors. The inverter module for the Backlight Unit is not built in.

1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- Fast response time
- High color saturation (EBU Like Specifications)
- SXGA (1280 x 1024 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface

1.3 APPLICATION

- TFT LCD Monitor

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	337.92 (H) x 270.34 (V) (17.0" diagonal)	mm	(1)
Bezel Opening Area	341.9 (H) x 274.4 (V)	mm	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 1024	pixel	-
Pixel Pitch	0.264 (H) x 0.264 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally black	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	358.0	358.5	359.0	mm	(1)
	Vertical(V)	296.0	296.5	297.0	mm	
	Depth(D)	-	17.0	17.5	mm	
Weight		-	-	1950	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity ranges are shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40$ °C).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40$ °C).

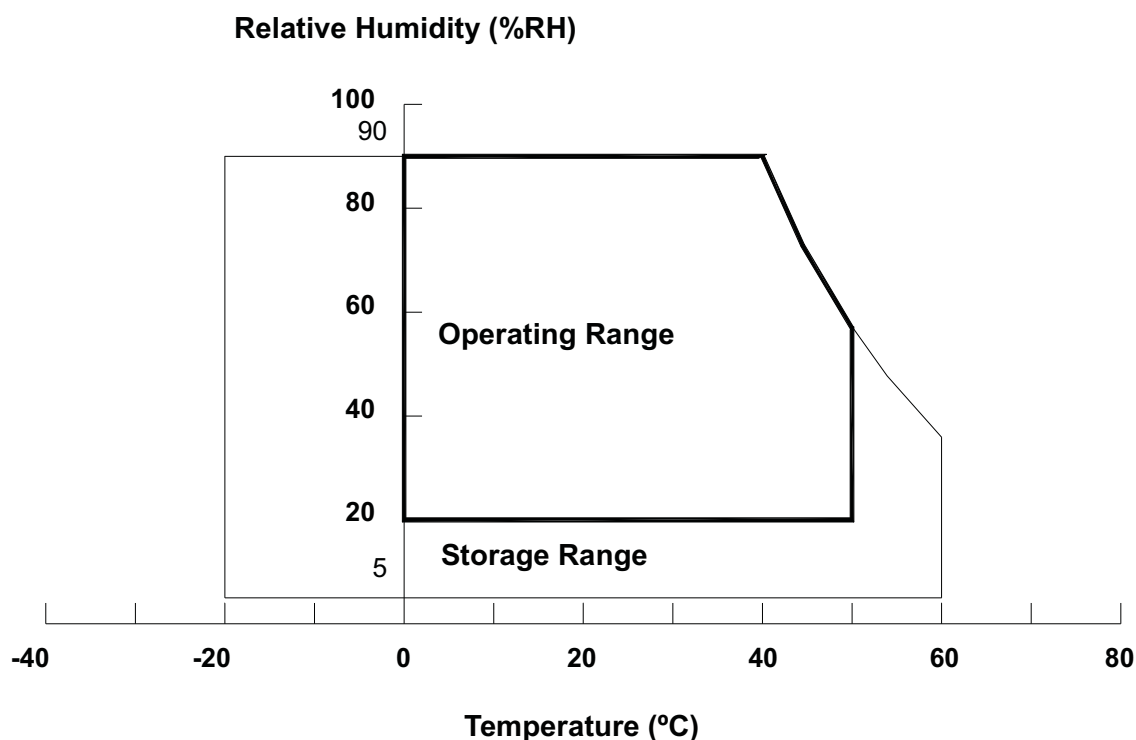
(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C Min. and 60 °C Max.

Note (3) 11ms, half-sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 300 Hz, sweep rate 10 min, 30 min for X, Y, Z. axis

Note (5) Upon the Vibration and Shock tests, the fixture used to hold the module must be firm and rigid enough to prevent the module from twisting or bending by the fixture.





2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	+6.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	4.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _L	-	2.5K	V _{RMS}	(1), (2), I _L = 6.5 mA
Lamp Current	I _L	-	7.0	mA _{RMS}	
Lamp Frequency	F _L	-	80	KHz	

Note (1) Permanent damage might occur if the module is operated at conditions exceeding the maximum values.

Note (2) Specified values are for lamps (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

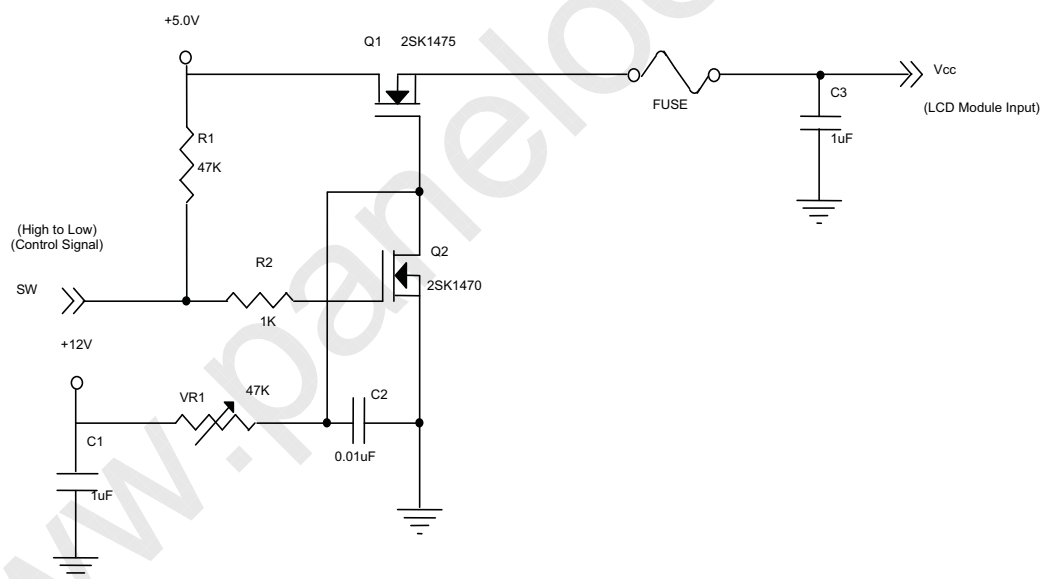
3.1 TFT LCD MODULE

 $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$

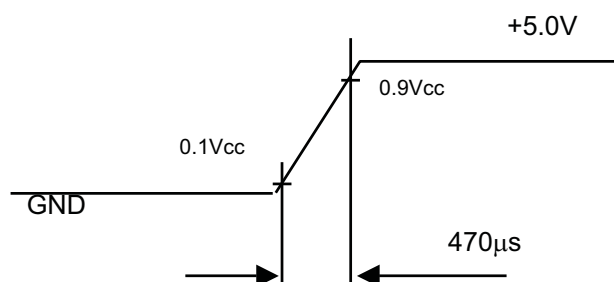
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	4.5	5.0	5.5	V	-
Ripple Voltage		V _{RP}	-	-	100	mV	-
Rush Current		I _{RUSH}	-	-	3.8	A	(2)
Power Supply Current	White	I _{CC}	-	1030	1350	mA	(3)a
	Black		-	520	700	mA	(3)b
	Vertical Stripe		-	930	1250	mA	(3)c
LVDS differential input voltage		V _{id}	100	-	+100	mV	
LVDS common input voltage		V _{ic}	-	1.2	-	V	
Logic "L" input voltage (SELLVDS)		V _{il}	V _{SS}	-	0.8	V	

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



V_{CC} rising time is 470μs



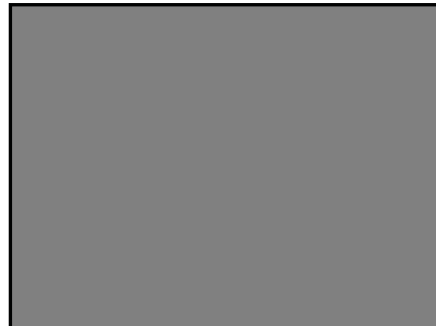
Note (3) The specified power supply current is under the conditions at $V_{CC} = 5.0\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



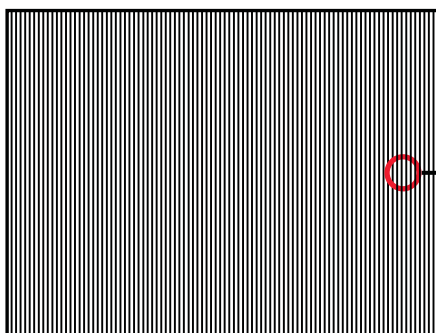
Active Area

b. Black Pattern

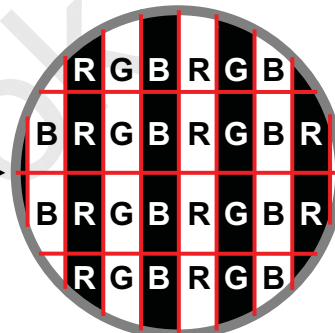


Active Area

c. Vertical Stripe Pattern



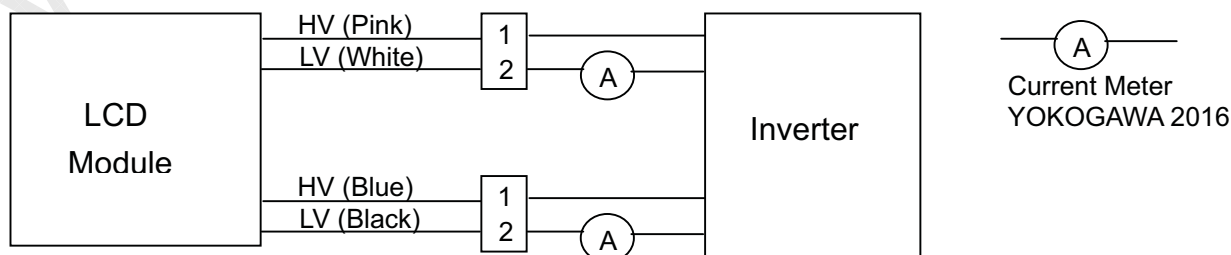
Active Area



3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	585	650	715	V_{RMS}	$I_L = 6.5\text{ mA}$
Lamp Current	I_L	2.0	6.5	7.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1290(25 $^{\circ}\text{C}$)	V_{RMS}	(2)
		-	-	1500(0 $^{\circ}\text{C}$)	V_{RMS}	(2)
Operating Frequency	F_L	40	55	80	KHz	(3)
Lamp Life Time	L_{BL}	50,000	-	-	Hrs	(5)
Power Consumption	P_L	-	16.9	-	W	(4), $I_L = 6.5\text{ mA}$

Note (1) Lamp current is measured by utilizing high-frequency current meters as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may produce interference with horizontal synchronization frequency from the display, which might cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronization frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition of $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = (2.0) \sim (6.5)$ mArms until one of the following events occurs:

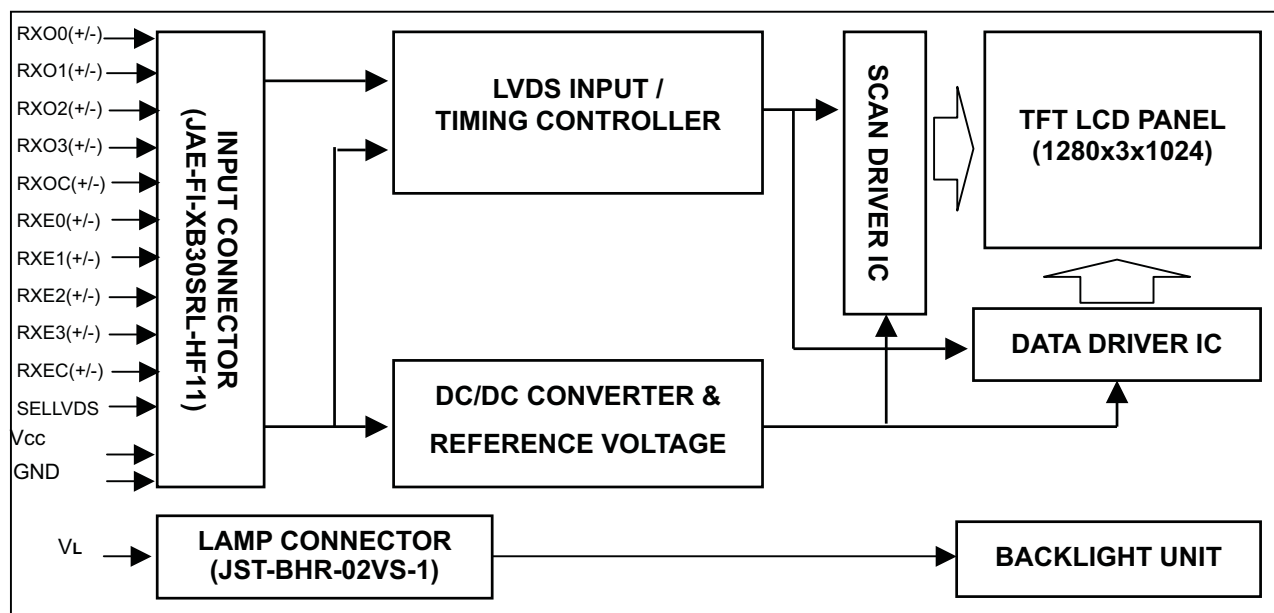
(a) When the brightness becomes lower than 50% of its original value.

(b) When the effective ignition length becomes lower than 80% of its original value. (Effective ignition length is defined as an area that has more than 70% of brightness compared to the brightness in the center point.)

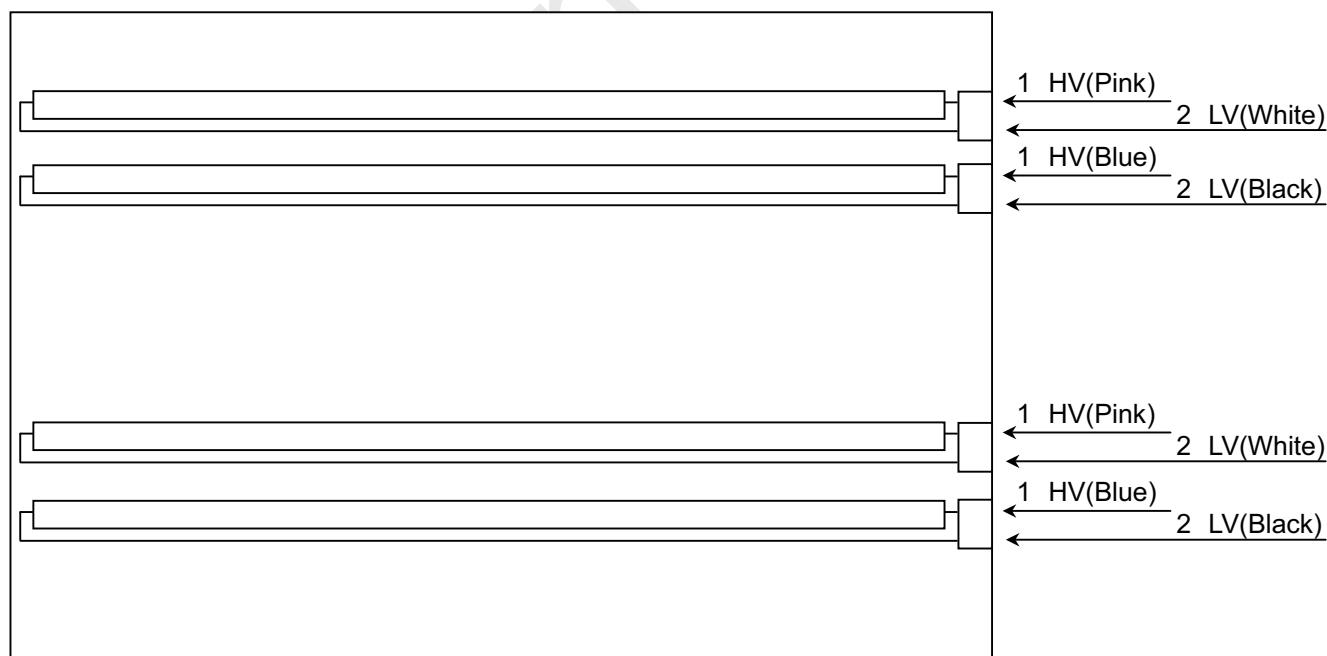
Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be designed carefully to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter, please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should operate in the same manner when it is installed to your instrument.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	RXE0-	Negative LVDS differential data input. Channel E0 (even)
2	RXE0+	Positive LVDS differential data input. Channel E0 (even)
3	RXE1-	Negative LVDS differential data input. Channel E1 (even)
4	RXE1+	Positive LVDS differential data input. Channel E1 (even)
5	RXE2-	Negative LVDS differential data input. Channel E2 (even)
6	RXE2+	Positive LVDS differential data input. Channel E2 (even)
7	GND	Ground
8	RXEC-	Negative LVDS differential clock input. (even)
9	RXEC+	Positive LVDS differential clock input. (even)
10	RXE3-	Negative LVDS differential data input. Channel E3 (even)
11	RXE3+	Positive LVDS differential data input. Channel E3 (even)
12	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
13	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
14	GND	Ground
15	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
16	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
17	GND	Ground
18	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
19	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
20	RXOC-	Negative LVDS differential clock input. (odd)
21	RXOC+	Positive LVDS differential clock input. (odd)
22	RXO3-	Negative LVDS differential data input. Channel O3 (odd)
23	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
24	GND	Ground
25	TEST	Test pin should be tied to ground or open.
26	NC	Not connection.
27	SELLVDS	SELLVDS pin should be tied to ground or open.
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

Note (1) Connector Part No.: FI-XB30SRL-HF11 (JAE)

Note (2) Mating connector Part No.: FI-X30H, FI-X30C*, FI-X30M*, FI-X30HL(-T), FI-X30C*L(-T)

Note (3) The first pixel is EVEN.



Note (3) Input signal of even and odd clock should be the same timing.

SELLVDS = Low or Open								
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6
LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6

5.2 BACKLIGHT UNIT

CONN. 1

Pin	Symbol	Description	Remark
1	HV1	High Voltage	Pink
2	LV	Ground	White

CONN. 2

Pin	Symbol	Description	Remark
1	HV1	High Voltage	BLUE
2	LV	Ground	Black

Note (1) Connector Part No.: BHR-02VS-1 (JST) or equivalent

Note (2) User's connector Part No.: SM02B-BHSS-1-TB (JST) or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

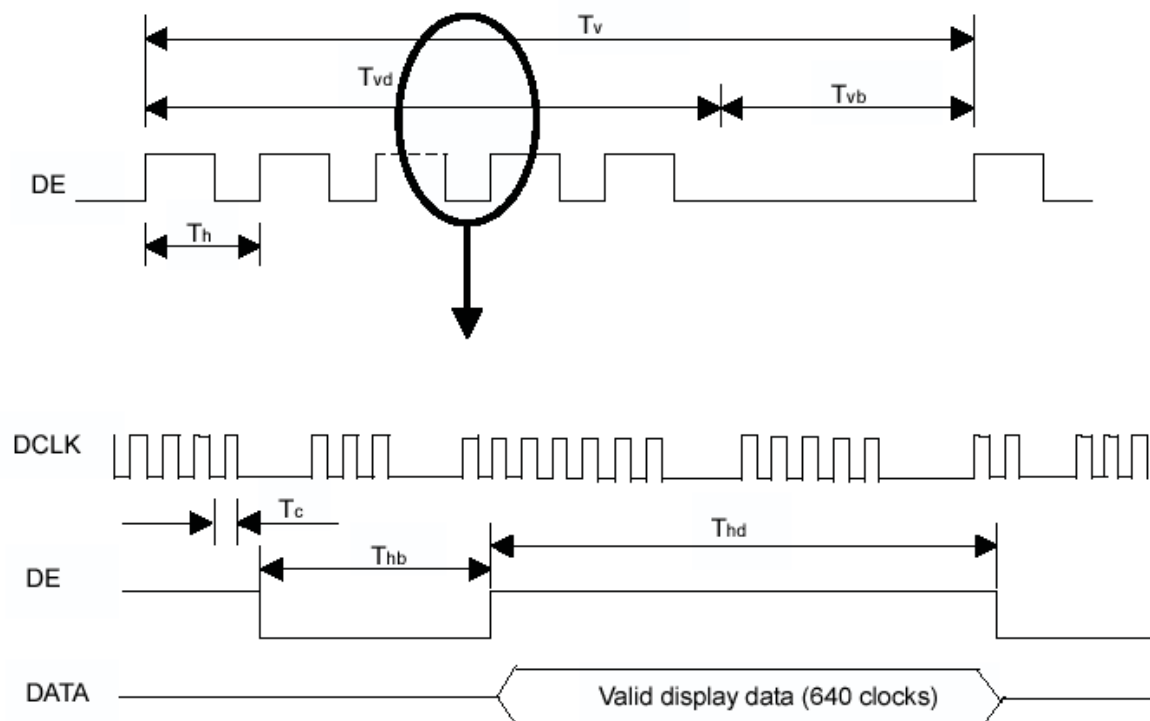
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown in the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	-	54	67.5	MHz	-
	Period	Tc	14.8	18.5	-	ns	-
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	56	60	75	Hz	Tv=Tvd+Tvb
	Total	Tv	1034	1066	1100	Th	-
	Display	Tvd	1024	1024	1024	Th	-
	Blank	Tvb	10	42	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	680	844	960	Tc	Th=Thd+Thb
	Display	Thd	640	640	640	Tc	-
	Blank	Thb	40	204	Th-Thd	Tc	-

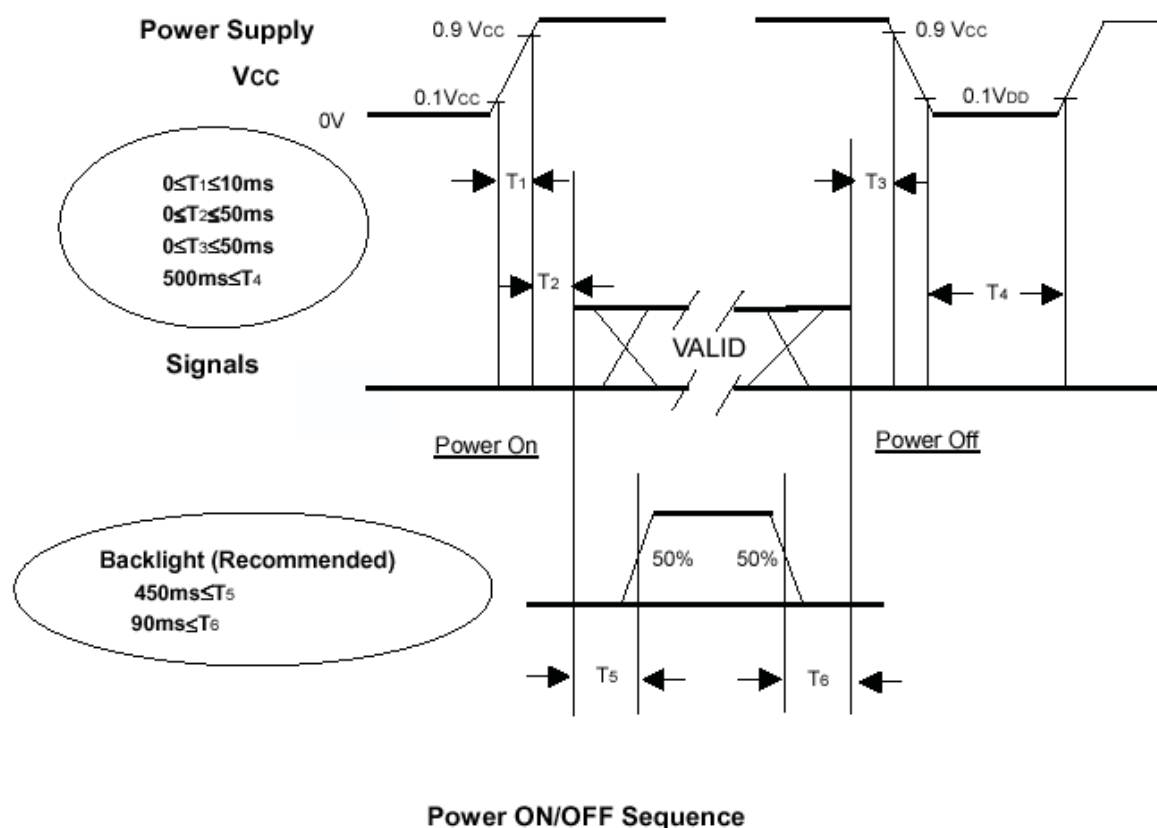
Note: For this module is operated under DE-only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



Note.

- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{CC}.
- (2) Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.
- (3) In case of V_{CC} = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T₄ should be measured after the module has been fully discharged between power on/off periods.
- (5) Interface signal should not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TESTING CONDITIONS

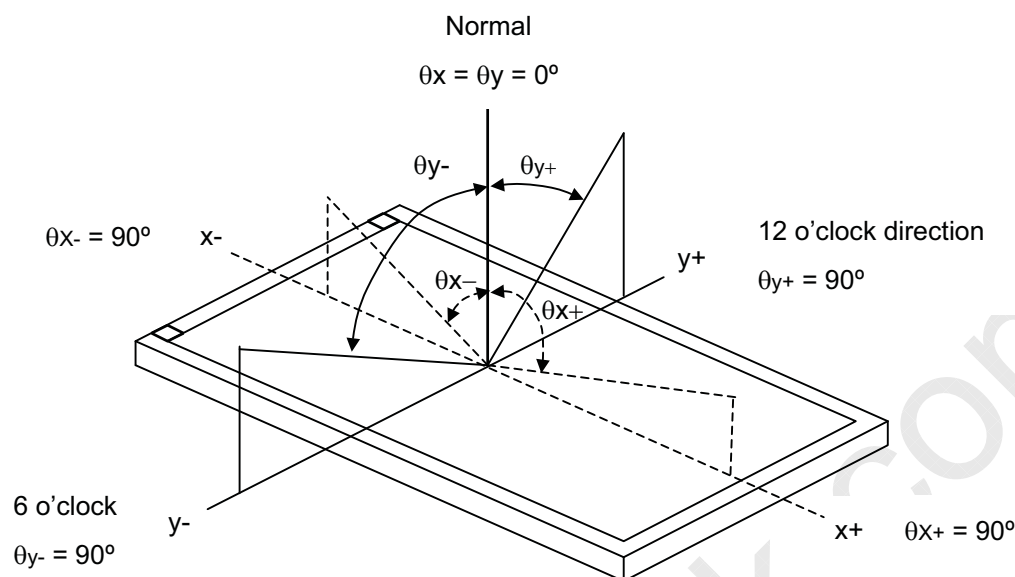
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	6.5	mA
Inverter Driving Frequency	F _L	50	KHz

7.2 OPTICAL SPECIFICATIONS

The measurement methods for the optical characteristics are explained in this section. The following items should be measured following the testing conditions described in section 7.1 under stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	400	600	-	-	(2), (6)
Response Time		T _R		-	15	30	ms	(3)
		T _F		-	10	25	ms	
Center Luminance of White		L _C		200	250	-	cd/m ²	(4), (6)
White Variation		δW		-	1.25	1.40	-	(6), (7)
Cross Talk		CT		-	-	2	%	(5), (6)
Color Chromaticity	Red	R _x		0.611	0.641	0.671	-	(1), (6)
		R _y		0.325	0.355	0.385	-	
	Green	G _x		0.255	0.285	0.315	-	
		G _y		0.567	0.597	0.627	-	
	Blue	B _x		0.112	0.142	0.172	-	
		B _y		0.041	0.071	0.101	-	
	White	W _x		0.283	0.313	0.343	-	
		W _y		0.299	0.329	0.359	-	
Color Gamut		CG		70.8	72	-	%	(1), (6),(8)
Gamma value		γ		2.0	2.2	2.4	-	
Viewing Angle	Horizontal	θ _{x+}	CR≥10	80	85	-	Deg.	(1), (6)
		θ _{x-}		80	85	-		
	Vertical	θ _{y+}		80	85	-		
		θ _{y-}		80	85	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

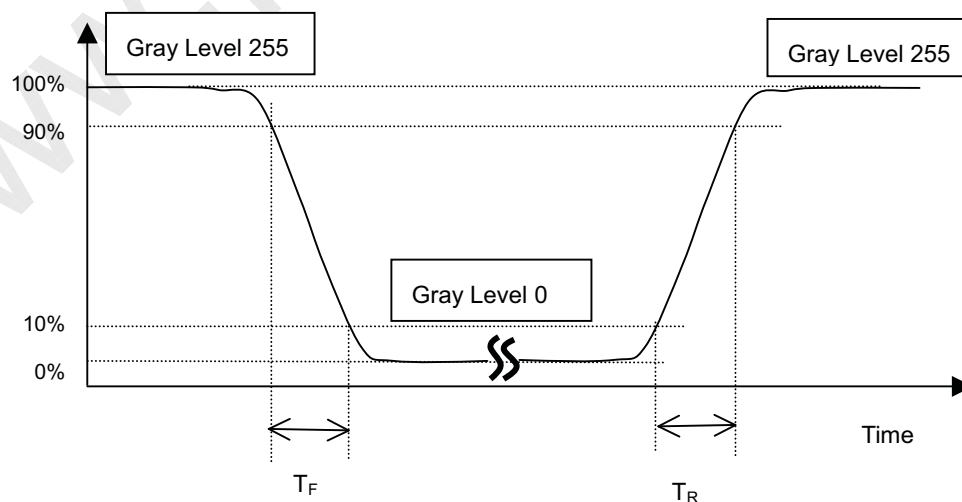
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 255 at center point

$$L_C = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (7).

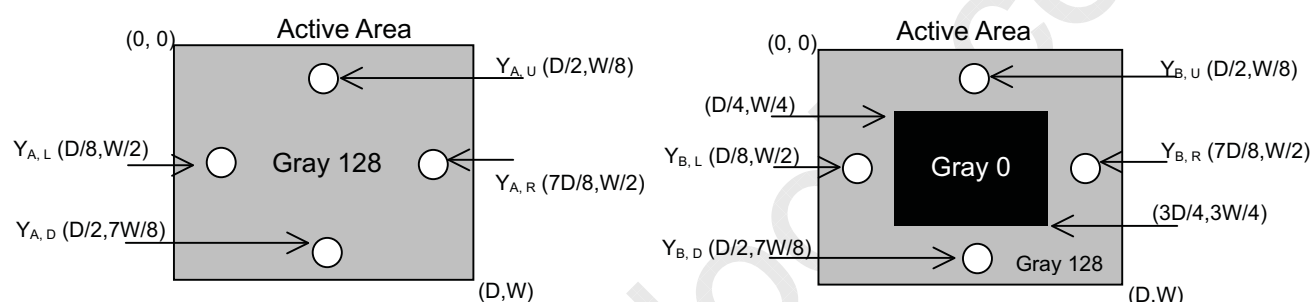
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

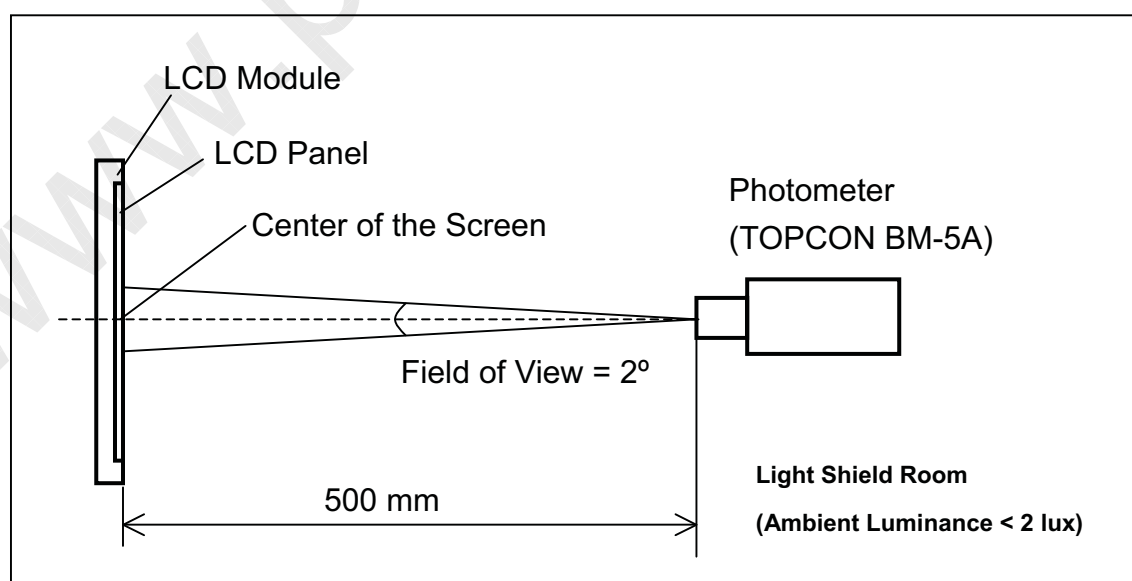
Where:

Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)


Note (6) Measurement Setup:

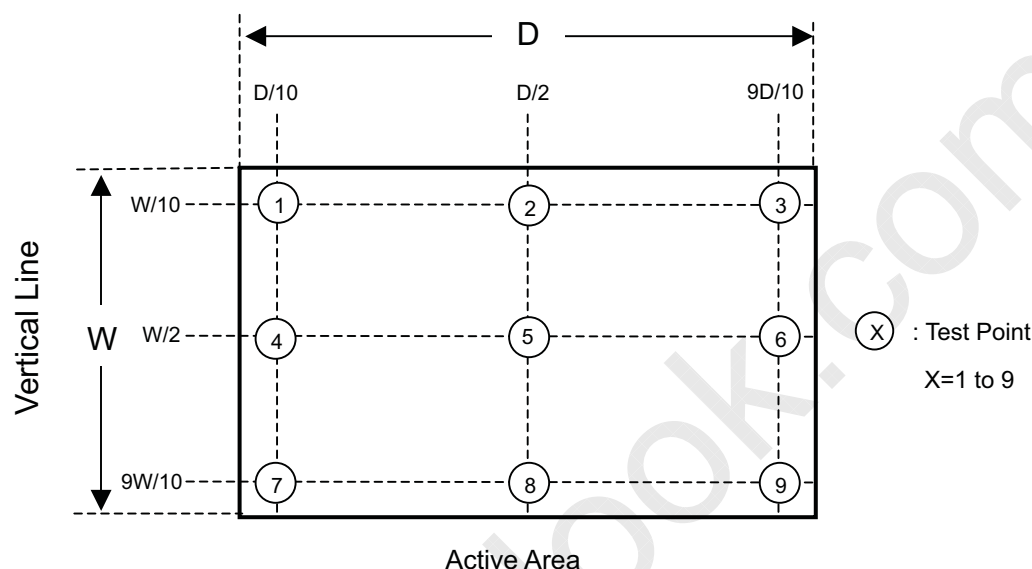
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measurement. In order to stabilize the luminance, the measurement should be executed after lighting backlight unit for 20 minutes in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5), L (6), L (7), L (8), L (9)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5), L (6), L (7), L (8), L (9)]}}$$



Note (8) Definition of Gamma Value (γ)

According to VESA2.0 - Flat Panel Display Measurements Standard 302.5A

$$L = a * G^{\gamma} + L_b$$

$$\log(L - L_b) = \gamma * \log(G) + \log(a)$$

L : Luminance

a : Constant

G : Gray level

L_b : Luminance at dark state

γ is the slope that best fits the log - log relationship



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Bending or twisting forces to the module during assembly should be avoided.
- (2) Please assemble the module into user's systems in clean working areas to prevent dusts and oils from causing electrical short-circuiting and from worsening the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

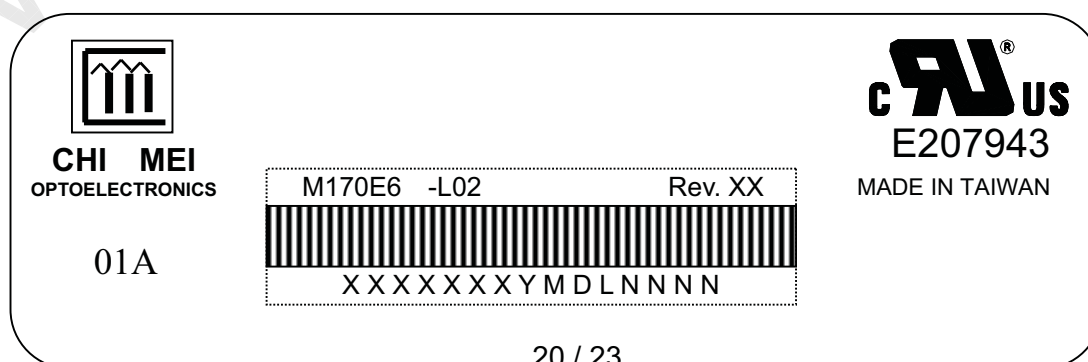
8.2 SAFETY PRECAUTIONS

- (1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

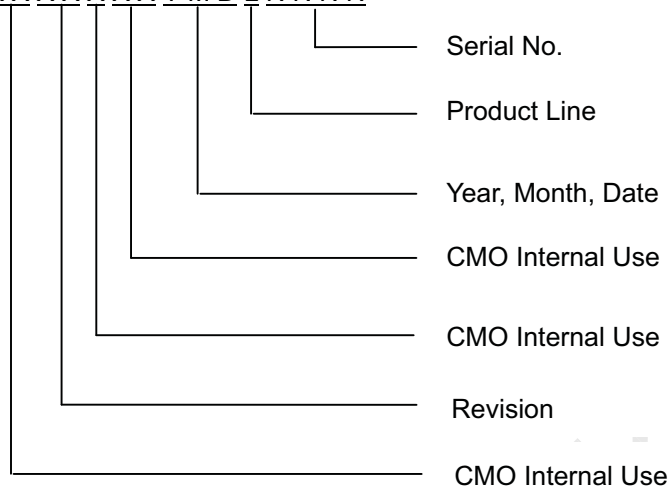




(a) Model Name: M170E6 -L02

(b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

(c) Serial ID: XXXXXXXYMDLNNNN



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

(b) Revision Code: Cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10. PACKAGING

10.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

(2) Box dimensions: 537(L) X 316(W) X 462(H) mm

(3) Weight: approximately 12Kg (5 modules per box)

10.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

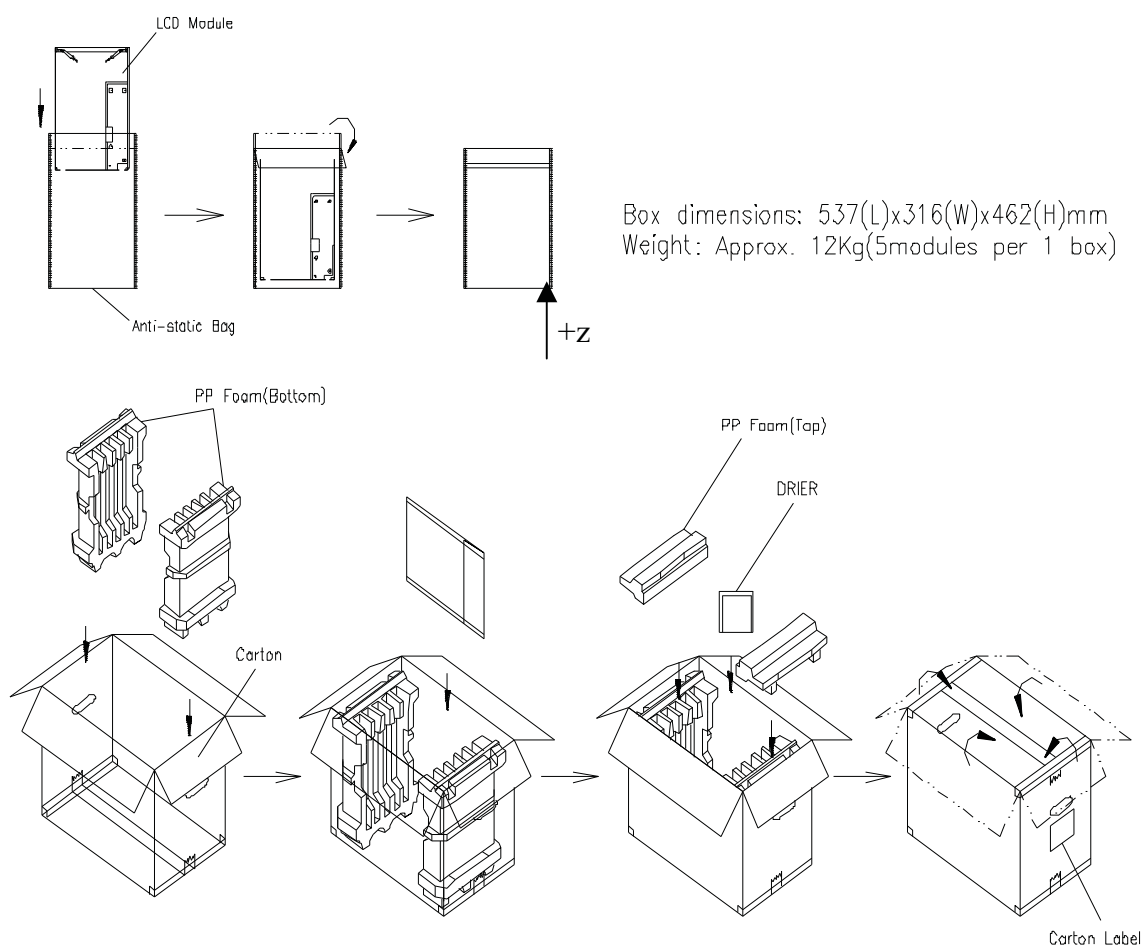
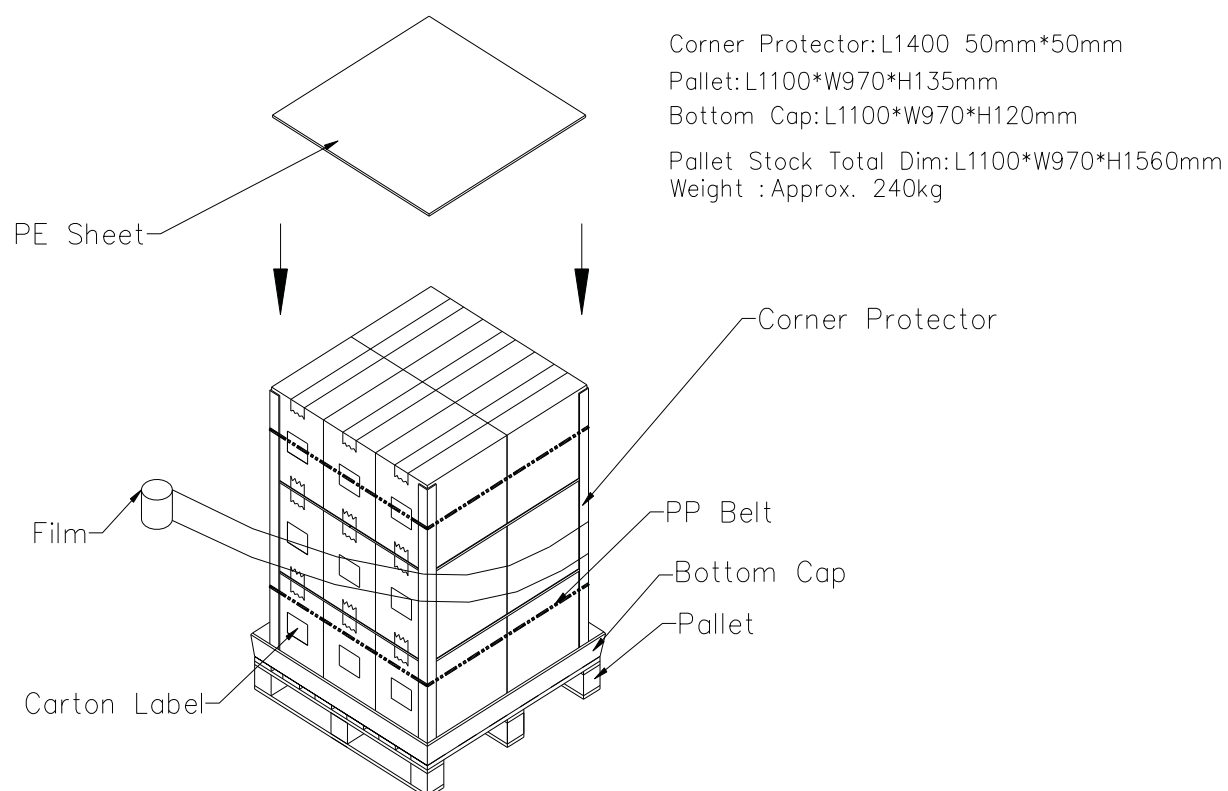
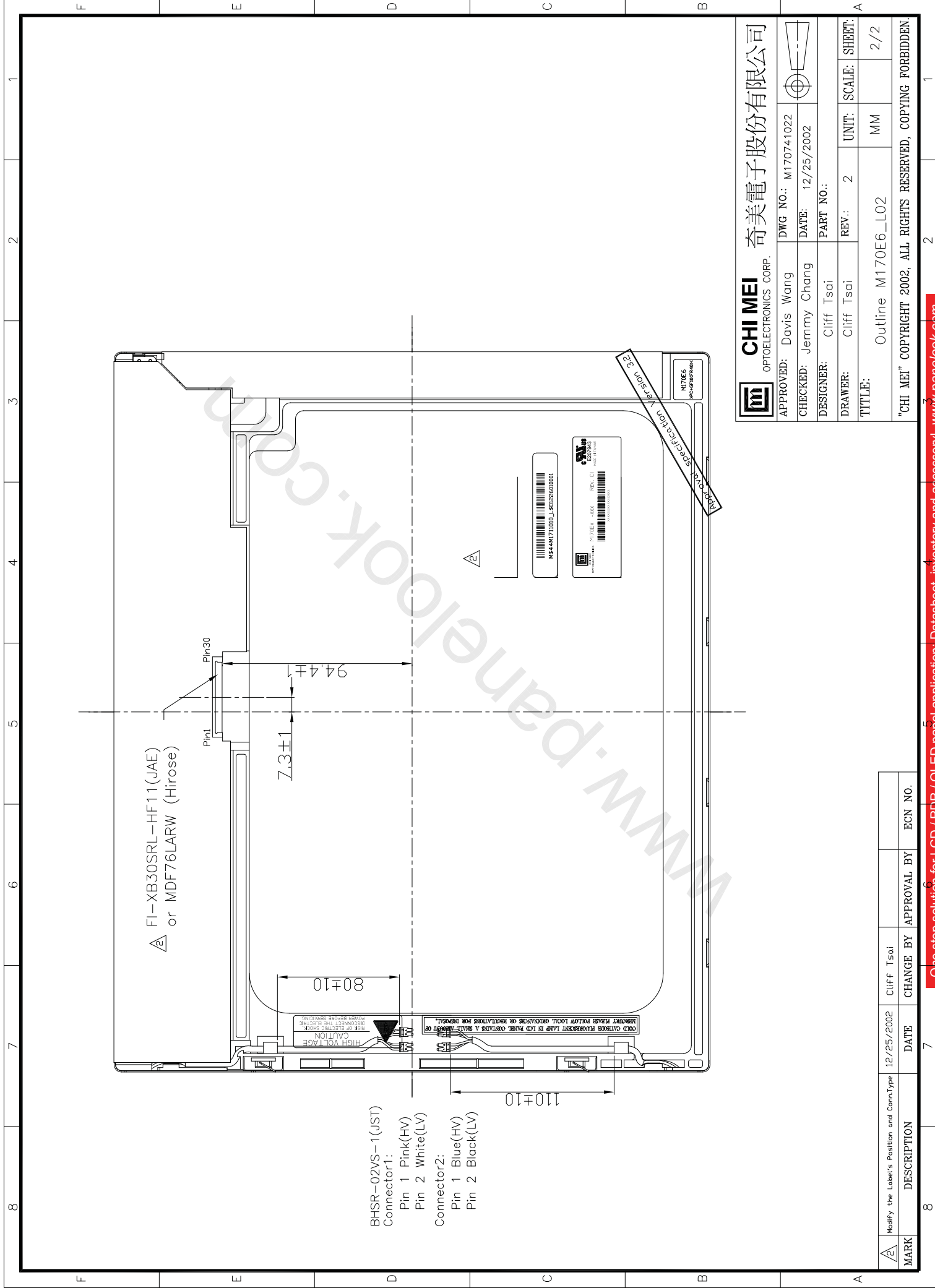


Figure. 10-1 Packing method

**Figure. 10-2 Packing method**



CHI MEI OPTOELECTRONICS CORP.		奇美電子股份有限公司	
APPROVED:	Davis Wang	DWG NO.:	M170741022
CHECKED:	Jemmy Chang	DATE:	12/25/2002
DESIGNER:	Cliff Tsai	PART NO.:	
DRAWER:	Cliff Tsai	REV.:	2
TITLE:	Outline M170E6_L02		UNIT: MM
		SCALE:	SHEET: 2/2
"CHI MEI" COPYRIGHT 2002, ALL RIGHTS RESERVED, COPYING FORBIDDEN.			

MARK	Modify the Label's Position and ConnType	DATE	CHANGE BY	APPROVAL BY	ECN NO.
	DESCRIPTION		Cliff Tsai		